

## Claims

[c1] 1.A method of mapping a combustor in a gas turbine engine, said method including:

- determining a first burner dome to be adjusted in said gas turbine engine for a first burner mode;
- adjusting a ring flame temperature at said first burner dome in said gas turbine engine to determine a maximum ring flame temperature boundary for said first burner dome;
- recording into memory a plurality of parameters from said plurality of sensors coupled to said gas turbine engine operating at said maximum ring flame temperature boundary;
- adjusting said ring flame temperature at said first burner dome in said gas turbine engine to determine a minimum ring flame temperature boundary for said first burner dome;
- recording into memory a plurality of parameters from said plurality of sensors coupled to the gas turbine engine operating at said minimum ring flame temperature boundary;
- subtracting a minimum ring flame temperature at said minimum ring flame temperature boundary from a maximum ring flame temperature at said maximum ring flame temperature boundary to determine a temperature window size;
- calculating a nominal ring flame temperature from the minimum and maximum ring flame temperatures when said temperature window size is greater than a predetermined minimum window size;
- adjusting the ring flame temperature in said first burner dome to said nominal ring flame temperature; and
- recording into memory a plurality of parameters from said sensors coupled to the gas turbine engine operating at said nominal ring flame temperature.

[c2] 2.The method of claim 1, further comprising:

- before said determining said first burner dome to be adjusted, adjusting a bulk combustor flame temperature from said gas turbine engine until readings from said plurality of sensors coupled to said gas turbine engine are within

predetermined operating limits.

[c3] 3.The method of claim 2, wherein said readings from said plurality of sensors include a NOx emissions level; and  
said adjusting said bulk combustor flame temperature includes:  
increasing said bulk combustor flame temperature in said gas turbine engine if said NOx emissions level is less than a predetermined lower limit NOx emissions level .

[c4] 4.The method of claim 2, wherein said readings from said plurality of sensors include a CO emissions level; and  
said adjusting said bulk combustor flame temperature includes:  
increasing said bulk combustor flame temperature in said gas turbine engine if said CO emissions level is greater than an upper limit CO emissions level.

[c5] 5.The method of claim 2, wherein said readings from said plurality of sensors include a NOx emissions level; and  
said adjusting said bulk combustor flame temperature includes:  
decreasing said bulk combustor flame temperature if said NOx emissions level is greater than a predetermined upper limit NOx emissions level for said gas turbine engine.

[c6] 6.The method of claim 2, wherein said adjusting said bulk combustor flame temperature includes:  
decreasing said bulk combustor flame temperature if said bulk combustor flame temperature is greater than a predetermined upper limit bulk combustor flame temperature.

[c7] 7.The method of claim 2, wherein said readings from said plurality of sensors include a high pressure turbine outlet temperature; and  
said adjusting said bulk combustor flame temperature further includes:  
decreasing said bulk combustor flame temperature if said bulk high pressure turbine outlet temperature is greater than a predetermined upper limit high pressure turbine outlet temperature.

[c8] 8.The method of claim 2, further comprising:

activating an alarm if said adjusting said bulk combustor flame temperature is performed a number of times greater than a predetermined number of times.

- [c9] 9.The method of claim 2, further comprising:  
repeating said adjusting said bulk combustor flame temperature if a NOx emissions level at said maximum temperature boundary is less than a predetermined upper limit NOx emissions level and said temperature window size is less than said predetermined minimum window size.
- [c10] 10.The method of claim 2, further comprising:  
repeating said adjusting said bulk combustor flame temperature if a NOx emissions level at said minimum temperature boundary is less than a predetermined upper limit NOx emissions level and said temperature window size is less than said predetermined minimum window size.
- [c11] 11.The method of claim 2, further comprising:  
repeating said adjusting said bulk combustor flame temperature if a high pressure turbine outlet temperature at said maximum temperature boundary is less than a predetermined upper limit high pressure turbine outlet temperature and said temperature window size is less than said predetermined minimum window size.
- [c12] 12.The method of claim 2, further comprising:  
repeating said adjusting said bulk combustor flame temperature if a high pressure turbine outlet temperature at said minimum temperature boundary is less than a predetermined upper limit high pressure turbine outlet temperature and said temperature window size is less than said predetermined minimum window size.
- [c13] 13.The method of claim 1, further comprising:  
activating an alarm if a NOx emissions level at said maximum temperature boundary is greater than a predetermined upper limit NOx emissions level and said temperature window size is less than said predetermined minimum window size.
- [c14] 14.The method of claim 2, further comprising:

repeating said adjusting said bulk combustor flame temperature if a high pressure turbine outlet temperature at said nominal ring flame temperature is greater than a predetermined upper limit high pressure turbine outlet temperature.

- [c15] 15.The method of claim 2, further comprising:  
repeating said adjusting said bulk combustor flame temperature if a NOx emissions level at said nominal ring flame temperature is greater than a predetermined upper limit NOx emissions level limit.
- [c16] 16.The method of claim 1, further comprising:  
activating an alarm if a NOx emissions level at said minimum temperature boundary is greater than a predetermined upper limit NOx emissions level and said temperature window size is less than said predetermined minimum window size.
- [c17] 17.The method of claim 1, further comprising:  
activating an alarm if a high pressure turbine outlet temperature at said maximum temperature boundary is greater than a predetermined upper limit high pressure turbine outlet temperature and said temperature window size is less than said predetermined minimum window size.
- [c18] 18.The method of claim 1, further comprising:  
activating an alarm if a high pressure turbine outlet temperature at said minimum temperature boundary is greater than a predetermined upper limit high pressure turbine outlet temperature and said temperature window size is less than said predetermined minimum window size.
- [c19] 19.The method of claim 1, wherein said determining said first burner dome to be adjusted includes:  
selecting said first burner mode in a lookup table to determine a sequence of burner domes to be adjusted for said first burner mode; and  
selecting said first burner dome from said sequence of burner domes to be adjusted.
- [c20] 20.The method of claim 19, wherein said selecting said first burner dome

includes:

setting a flag to identify an adjusted burner dome in said plurality of burner domes to be adjusted for said first burner mode.

[c21] 21.The method of claim 1, wherein said adjusting a ring flame temperature at said first burner dome in said gas turbine engine to determine a maximum ring flame temperature boundary includes:  
incrementing said ring flame temperature at said first burner dome in said gas turbine engine by a predetermined amount; and  
detecting the activation of a acoustics and blow out avoidance logic.

[c22] 22.The method of claim 1, wherein said adjusting a ring flame temperature at said first burner dome in said gas turbine engine to determine a maximum ring flame temperature boundary includes:  
incrementing said ring flame temperature at said first burner dome in said gas turbine engine by a predetermined amount to achieve an incremented ring flame temperature;  
recording into memory a plurality of parameters from said plurality of sensors coupled to said gas turbine engine operating at said incremented ring flame temperature; and  
repeating said incrementing if said plurality of parameters are within predetermined acoustics and blowout boundaries.

[c23] 23.The method of claim 1, wherein said adjusting a ring flame temperature at said first burner dome in said gas turbine engine to determine a maximum ring flame temperature boundary includes:  
incrementing said ring flame temperature at said first burner dome in said gas turbine engine by a predetermined amount to achieve an incremented ring flame temperature;  
recording into memory a plurality of parameters from said plurality of sensors coupled to said gas turbine engine operating at said incremented ring flame temperature; and  
repeating said incrementing if said plurality of parameters are within predetermined acoustics and blowout boundaries and said ring flame

temperature at said first burner dome is less than a predetermined maximum ring flame temperature.

[c24] 24.The method of claim 1, wherein said adjusting a ring flame temperature at said first burner dome in said gas turbine engine to determine a minimum ring flame temperature boundary includes:  
decrementing said ring flame temperature at said first burner dome in said gas turbine engine by a predetermined amount; and  
detecting the activation of a acoustics and blow out avoidance logic.

[c25] 25.The method of claim 1, wherein said adjusting a ring flame temperature at said first burner dome in said gas turbine engine to determine a minimum ring flame temperature boundary includes:  
decrementing said ring flame temperature at said first burner dome in said gas turbine engine by a predetermined amount to achieve an decremented ring flame temperature;  
recording into memory a plurality of parameters from said plurality of sensors coupled to said gas turbine engine operating at said decremented ring flame temperature; and  
repeating said decrementing if said plurality of parameters are within predetermined acoustics and blowout boundaries.

[c26] 26.The method of claim 1, wherein said calculating said nominal ring flame temperature includes:  
incrementing said ring flame temperature at said minimum ring flame temperature boundary by a predetermined amount.

[c27] 27.The method of claim 1, wherein said calculating said nominal ring flame temperature includes:  
decrementing said ring flame temperature at said maximum ring flame temperature boundary by a predetermined amount.

[c28] 28.The method of claim 1, wherein said calculating said nominal ring flame temperature includes:  
averaging said ring flame temperature at said maximum ring flame temperature

boundary and said ring flame temperature at said minimum ring flame temperature boundary.

[c29] 29.The method of claim 1, further comprising:  
determining a second burner dome to be adjusted for said first burner mode when said high pressure turbine outlet temperature at said nominal ring flame temperature is less than a predetermined upper limit high pressure turbine outlet temperature and a NOx emissions level at said nominal ring flame temperature is less than a predetermined upper limit NOx emissions level.

[c30] 30.The method of claim 1, further comprising:  
receiving input indicating a new burner mode if all burner domes for said first mode have been adjusted.

[c31] 31.A storage medium encoded with machine-readable computer program code for mapping a combustor in a gas turbine engine, the storage medium including instructions for causing a computer to implement a method comprising:  
determining a first burner dome to be adjusted in said gas turbine engine for a first burner mode;  
adjusting a ring flame temperature at said first burner dome in said gas turbine engine to determine a maximum ring flame temperature boundary for said first burner dome;  
recording into memory a plurality of parameters from said plurality of sensors coupled to said gas turbine engine operating at said maximum ring flame temperature boundary;  
adjusting said ring flame temperature at said first burner dome in said gas turbine engine to determine a minimum ring flame temperature boundary for said first burner dome;  
recording into memory a plurality of parameters from said plurality of sensors coupled to the gas turbine engine operating at said minimum ring flame temperature boundary;  
subtracting a minimum ring flame temperature at said minimum ring flame temperature boundary from a maximum ring flame temperature at said maximum ring flame temperature boundary to determine a temperature window

size;

calculating a nominal ring flame temperature from the minimum and maximum ring flame temperatures when said temperature window size is greater than a predetermined minimum window size;

adjusting the ring flame temperature in said first burner dome to said nominal ring flame temperature; and

recording into memory a plurality of parameters from said sensors coupled to the gas turbine engine operating at said nominal ring flame temperature.

[c32] 32.The storage medium of claim 31 further including instructions for causing a computer to implement:

before said determining said first burner dome to be adjusted, adjusting a bulk combustor flame temperature from said gas turbine engine until readings from said plurality of sensors coupled to said gas turbine engine are within predetermined operating limits.

[c33] 33.The storage medium of claim 32, wherein said readings from said plurality of sensors include a NOx emissions level; and  
said adjusting said bulk combustor flame temperature includes:  
increasing said bulk combustor flame temperature in said gas turbine engine if said NOx emissions level is less than a predetermined lower limit NOx emissions level.

[c34] 34.The storage medium of claim 32, wherein said readings from said plurality of sensors include a CO emissions level; and  
said adjusting said bulk combustor flame temperature includes:  
increasing said bulk combustor flame temperature in said gas turbine engine if said CO emissions level is greater than an upper limit CO emissions level.

[c35] 35.The storage medium of claim 32, wherein said readings from said plurality of sensors include a NOx emissions level; and  
said adjusting said bulk combustor flame temperature further includes:  
decreasing said bulk combustor flame temperature if said NOx emissions level is greater than a predetermined upper limit NOx emissions level for said gas turbine engine.



[c36] 36.The storage medium of claim 32, wherein said adjusting said bulk combustor flame temperature further includes:  
decreasing said bulk combustor flame temperature if said bulk combustor flame temperature is greater than a predetermined upper limit bulk combustor flame temperature.

[c37] 37.The storage medium of claim 32, wherein said readings from said plurality of sensors include a bulk high pressure turbine outlet temperature; and said adjusting said bulk combustor flame temperature further includes:  
decreasing said bulk combustor flame temperature if said bulk high pressure turbine outlet temperature is greater than a predetermined upper limit high pressure turbine outlet temperature.

[c38] 38.The storage medium of claim 32, further including instructions for causing a computer to implement:  
activating an alarm if said adjusting said bulk combustor flame temperature is performed a number of times greater than a predetermined number of times.

[c39] 39.The storage medium of claim 32, further including instructions for causing a computer to implement:  
repeating said adjusting said bulk combustor flame temperature if a NOx emissions level at said maximum temperature boundary is less than a predetermined upper limit NOx emissions level and said temperature window size is less than said predetermined minimum window size.

[c40] 40.The storage medium of claim 32, further including instructions for causing a computer to implement:  
repeating said adjusting said bulk combustor flame temperature if a NOx emissions level at said minimum temperature boundary is less than a predetermined upper limit NOx emissions level and said temperature window size is less than said predetermined minimum window size.

[c41] 41.The storage medium of claim 32, further including instructions for causing a computer to implement:  
repeating said adjusting said bulk combustor flame temperature if a high

pressure turbine outlet temperature at said maximum temperature boundary is less than a predetermined upper limit high pressure turbine outlet temperature and said temperature window size is less than said predetermined minimum window size.

[c42] 42.The storage medium of claim 32, further including instructions for causing a computer to implement:

repeating said adjusting said bulk combustor flame temperature if a high pressure turbine outlet temperature at said minimum temperature boundary is less than a predetermined upper limit high pressure turbine outlet temperature and said temperature window size is less than said predetermined minimum window size.

[c43] 43.The storage medium of claim 31, further including instructions for causing a computer to implement:

activating an alarm if a NOx emissions level at said maximum temperature boundary is greater than a predetermined upper limit NOx emissions level and said temperature window size is less than said predetermined minimum window size.

[c44] 44.The storage medium of claim 32, further including instructions for causing a computer to implement:

repeating said adjusting said bulk combustor flame temperature if a high pressure turbine outlet temperature at said nominal ring flame temperature is greater than a predetermined upper limit high pressure turbine outlet temperature.

[c45] 45.The storage medium of claim 32, further including instructions for causing a computer to implement:

repeating said adjusting said bulk combustor flame temperature if said NOx emissions level at said nominal ring flame temperature is greater than a predetermined upper limit NOx emissions level limit.

[c46] 46.The storage medium of claim 31, further including instructions for causing a computer to implement:

activating an alarm if a NOx emissions level at said minimum temperature boundary is greater than a predetermined upper limit NOx emissions level and said temperature window size is less than said predetermined minimum window size.

[c47] 47.The storage medium of claim 31, further including instructions for causing a computer to implement:

activating an alarm if said a high pressure turbine outlet temperature at said maximum temperature boundary is greater than a predetermined upper limit high pressure turbine outlet temperature and said temperature window size is less than said predetermined minimum window size.

[c48] 48.The storage medium of claim 31, further including instructions for causing a computer to implement:

activating an alarm if a high pressure turbine outlet temperature at said minimum temperature boundary is greater than a predetermined upper limit high pressure turbine outlet temperature and said temperature window size is less than said predetermined minimum window size.

[c49] 49.The storage medium of claim 31, wherein said determining said first burner dome to be adjusted includes:

selecting said first burner mode in a lookup table to determine a sequence of burner domes to be adjusted for said first burner mode; and  
selecting said first burner dome from said sequence of burner domes to be adjusted.

[c50] 50.The storage medium of claim 49, wherein said selecting said first burner dome includes:

setting a flag to identify an adjusted burner dome in said plurality of burner domes to be adjusted for said first burner mode.

[c51] 51.The storage medium of claim 31, wherein said adjusting a ring flame temperature at said first burner dome in said gas turbine engine to determine a maximum ring flame temperature boundary includes:

incrementing said ring flame temperature at said first burner dome in said gas

turbine engine by a predetermined amount; and  
detecting the activation of a acoustics and blow out avoidance logic.

[c52] 52.The storage medium of claim 31, wherein said adjusting a ring flame temperature at said first burner dome in said gas turbine engine to determine a maximum ring flame temperature boundary includes:  
incrementing said ring flame temperature at said first burner dome in said gas turbine engine by a predetermined amount to achieve an incremented ring flame temperature;  
recording into memory a plurality of parameters from said plurality of sensors coupled to said gas turbine engine operating at said incremented ring flame temperature; and  
repeating said incrementing if said plurality of parameters are within predetermined acoustics and blowout boundaries.

[c53] 53.The storage medium of claim 31, wherein said adjusting a ring flame temperature at said first burner dome in said gas turbine engine to determine a maximum ring flame temperature boundary includes:  
incrementing said ring flame temperature at said first burner dome in said gas turbine engine by a predetermined amount to achieve an incremented ring flame temperature;  
recording into memory a plurality of parameters from said plurality of sensors coupled to said gas turbine engine operating at said incremented ring flame temperature; and  
repeating said incrementing if said plurality of parameters are within predetermined acoustics and blowout boundaries and said ring flame temperature at said first burner dome is less than a predetermined maximum ring flame temperature.

[c54] 54.The storage medium of claim 31, wherein said adjusting a ring flame temperature at said first burner dome in said gas turbine engine to determine a minimum ring flame temperature boundary includes:  
decrementing said ring flame temperature at said first burner dome in said gas turbine engine by a predetermined amount; and

detecting the activation of a acoustics and blow out avoidance logic.

[c55] 55.The storage medium of claim 31, wherein said adjusting a ring flame temperature at said first burner dome in said gas turbine engine to determine a minimum ring flame temperature boundary includes:  
decrementing said ring flame temperature at said first burner dome in said gas turbine engine by a predetermined amount to achieve an decremented ring flame temperature;  
recording into memory a plurality of parameters from said plurality of sensors coupled to said gas turbine engine operating at said decremented ring flame temperature; and  
repeating said decrementing if said plurality of parameters are within predetermined acoustics and blowout boundaries.

[c56] 56.The storage medium of claim 31, wherein said calculating said nominal ring flame temperature includes:  
incrementing said ring flame temperature at said minimum ring flame temperature boundary by a predetermined amount.

[c57] 57.The storage medium of claim 31, wherein said calculating said nominal ring flame temperature includes:  
decrementing said ring flame temperature at said maximum ring flame temperature boundary by a predetermined amount.

[c58] 58.The storage medium of claim 31, wherein said calculating said nominal ring flame temperature includes:  
averaging said ring flame temperature at said maximum ring flame temperature boundary and said ring flame temperature at said minimum ring flame temperature boundary.

[c59] 59.The storage medium of claim 31, further including instructions for causing a computer to implement:  
determining a second burner dome to be adjusted for said first burner mode when a high pressure turbine outlet temperature at said nominal ring flame temperature is less than a predetermined upper limit high pressure turbine

outlet temperature and said NOx emissions level at said nominal ring flame temperature is less than a predetermined upper limit NOx emissions level.

[c60] 60.The storage medium of claim 31, further including instructions for causing a computer to implement:  
receiving input indicating a new burner mode if all burner domes for said first mode have been adjusted.

[c61] 61.A system for mapping a combustor in a gas turbine engine, said system including:  
a plurality of sensors operably coupled to said combustor;  
a controller operably coupled to said combustor for controlling combustion in a plurality of domes in said combustor;  
a memory device operably coupled to said controller, said memory device including data for use by said controller in controlling combustion in said plurality of domes;  
a mapping device operably coupled to said plurality of sensors and to said memory device, said mapping device is configured to:  
determine a maximum ring flame temperature boundary for a first burner dome in said plurality of burner domes to be adjusted for a first burner mode;  
record into said memory device a plurality of parameters from said plurality of sensors coupled to said gas turbine engine operating at a maximum ring flame temperature boundary;  
determine a minimum ring flame temperature boundary for said first burner dome;  
record into said memory device a plurality of parameters from said plurality of sensors coupled to the gas turbine engine operating at said minimum ring flame temperature boundary;  
subtract a ring flame temperature at said minimum ring flame temperature boundary from a ring flame temperature at said maximum ring flame temperature boundary to determine a temperature window size;  
calculate a nominal ring flame temperature from the minimum and maximum ring flame temperatures when said temperature window size is greater than a predetermined minimum window size; and

record into said memory device a plurality of parameters from said sensors coupled to the gas turbine engine operating at said nominal ring flame temperature.

[c62] 62.The system of claim 61, wherein said mapping device causes said controller to adjust a bulk combustor flame temperature from said gas turbine engine until readings from said plurality of sensors coupled to said gas turbine engine are within predetermined operating limits.

[c63] 63.The system of claim 62, wherein said readings from said plurality of sensors include a NOx emissions level; and wherein said mapping device causes said controller to increase said bulk combustor flame temperature in said combustor if said NOx emissions level is less than a predetermined lower limit NOx emissions level.

[c64] 64.The system of claim 62, wherein said readings from said plurality of sensors include a CO emissions level; and wherein said mapping device causes said controller to increase said bulk combustor flame temperature in said gas turbine engine if said CO emissions level is greater than an upper limit CO emissions level.

[c65] 65.The system of claim 62, wherein said readings from said plurality of sensors include a NOx emissions level; and wherein said mapping device causes said controller to decrease said bulk combustor flame temperature if said NOx emissions level is greater than a predetermined upper limit NOx emissions level for said gas turbine engine.

[c66] 66.The system of claim 62, wherein said readings from said plurality of sensors include a bulk combustor flame temperature; and wherein said mapping device causes said controller to decrease said bulk combustor flame temperature if said bulk combustor flame temperature is greater than a predetermined upper limit bulk combustor flame temperature.

[c67] 67.The system of claim 62, wherein said readings from said plurality of sensors include a high pressure turbine outlet temperature; and wherein said mapping device causes said controller to decrease said bulk combustor flame

temperature if said high pressure turbine outlet temperature is greater than a predetermined upper limit high pressure turbine outlet temperature.

- [c68] 68.The system of claim 62, wherein said mapping device activates an alarm if said bulk combustor flame temperature is adjusted a number of times greater than a predetermined number of times.
- [c69] 69.The system of claim 62, wherein said mapping device causes said controller to adjust said bulk combustor flame temperature if a NOx emissions level at said maximum temperature boundary is less than a predetermined upper limit NOx emissions level and said temperature window size is less than said predetermined minimum window size.
- [c70] 70.The system of claim 62, wherein said mapping device causes said controller to adjust said bulk combustor flame temperature if a NOx emissions level at said minimum temperature boundary is less than a predetermined upper limit NOx emissions level and said temperature window size is less than said predetermined minimum window size.
- [c71] 71.The system of claim 62, wherein said mapping device causes said controller to adjust said bulk combustor flame temperature if a high pressure turbine outlet temperature at said maximum temperature boundary is less than a predetermined upper limit high pressure turbine outlet temperature and said temperature window size is less than said predetermined minimum window size.
- [c72] 72.The system of claim 62, wherein said mapping device causes said controller to adjust said bulk combustor flame temperature if a high pressure turbine outlet temperature at said minimum temperature boundary is less than a predetermined upper limit high pressure turbine outlet temperature and said temperature window size is less than said predetermined minimum window size.
- [c73] 73.The system of claim 61, wherein said mapping device activates an alarm if a NOx emissions level at said maximum temperature boundary is greater than a predetermined upper limit NOx emissions level and said temperature window



size is less than said predetermined minimum window size.

[c74] 74.The system of claim 62, wherein said mapping device causes said controller to adjust said bulk combustor flame temperature if a high pressure turbine outlet temperature at said nominal ring flame temperature is greater than a predetermined upper limit high pressure turbine outlet temperature.

[c75] 75.The system of claim 62, wherein said mapping device causes said controller to adjust said bulk combustor flame temperature if a NOx emissions level at said nominal ring flame temperature is greater than a predetermined upper limit NOx emissions level limit.

[c76] 76.The system of claim 61, wherein said mapping device activates an alarm if a NOx emissions level at said minimum temperature boundary is greater than a predetermined upper limit NOx emissions level and said temperature window size is less than said predetermined minimum window size.

[c77] 77.The system of claim 61, wherein said mapping device activates an alarm if a high pressure turbine outlet temperature at said maximum temperature boundary is greater than a predetermined upper limit high pressure turbine outlet temperature and said temperature window size is less than said predetermined minimum window size.

[c78] 78.The system of claim 61, wherein said mapping device activates an alarm if a high pressure turbine outlet temperature at said minimum temperature boundary is greater than a predetermined upper limit high pressure turbine outlet temperature and said temperature window size is less than said predetermined minimum window size.

[c79] 79.The system of claim 61, wherein said mapping device selects said first burner mode in a lookup table to determine a sequence of burner domes to be adjusted for said first burner mode.

[c80] 80.The system of claim 79, wherein said mapping device sets a flag to identify an adjusted burner dome in said plurality of burner domes to be adjusted for said first burner mode.

[c81] 81.The system of claim 61, wherein said mapping device causes said controller to increment said ring flame temperature at said first burner dome in said gas turbine engine by a predetermined amount, and said mapping device detects the activation of a acoustics and blow out avoidance logic.

[c82] 82.The system of claim 61, wherein said mapping device causes said controller to increment said ring flame temperature at said first burner dome in said gas turbine engine by a predetermined amount to achieve an incremented ring flame temperature, and said mapping device records into said memory device a plurality of parameters from said plurality of sensors coupled to said gas turbine engine operating at said incremented ring flame temperature.

[c83] 83.The system of claim 61, wherein said mapping device causes said controller to increment said ring flame temperature at said first burner dome in said gas turbine engine by a predetermined amount to achieve an incremented ring flame temperature, and said mapping device records into said memory device a plurality of parameters from said plurality of sensors coupled to said gas turbine engine operating at said incremented ring flame temperature.

[c84] 84.The system of claim 61, wherein said mapping device causes said controller to decrement said ring flame temperature at said first burner dome in said gas turbine engine by a predetermined amount, and said mapping device detects the activation of a acoustics and blow out avoidance logic.

[c85] 85.The system of claim 61, wherein said mapping device causes said controller to decrement said ring flame temperature at said first burner dome in said gas turbine engine by a predetermined amount to achieve a decremented ring flame temperature, and said mapping device records into said memory device a plurality of parameters from said plurality of sensors coupled to said gas turbine engine operating at said decremented ring flame temperature.

[c86] 86.The system of claim 61, wherein said mapping device calculates said nominal ring flame temperature by averaging said ring flame temperature at said maximum ring flame temperature boundary and said ring flame temperature at said minimum ring flame temperature boundary.

- [c87] 87.The system of claim 61, wherein said mapping device calculates said nominal ring flame temperature by incrementing said ring flame temperature at said minimum ring flame temperature boundary by a predetermined amount.
- [c88] 88.The system of claim 61, wherein said mapping device calculates said nominal ring flame temperature by decrementing said ring flame temperature at said maximum ring flame temperature boundary by a predetermined amount.
- [c89] 89.The system of claim 61, wherein said mapping device determines a second burner dome to be adjusted for said first burner mode when said high pressure turbine outlet temperature at said nominal ring flame temperature is less than a predetermined upper limit high pressure turbine outlet temperature and a NOx emissions level at said nominal ring flame temperature is less than a predetermined upper limit NOx emissions level.
- [c90] 90.The system of claim 61, wherein said mapping device receives input indicating a new burner mode if all burner domes for said first mode have been adjusted.